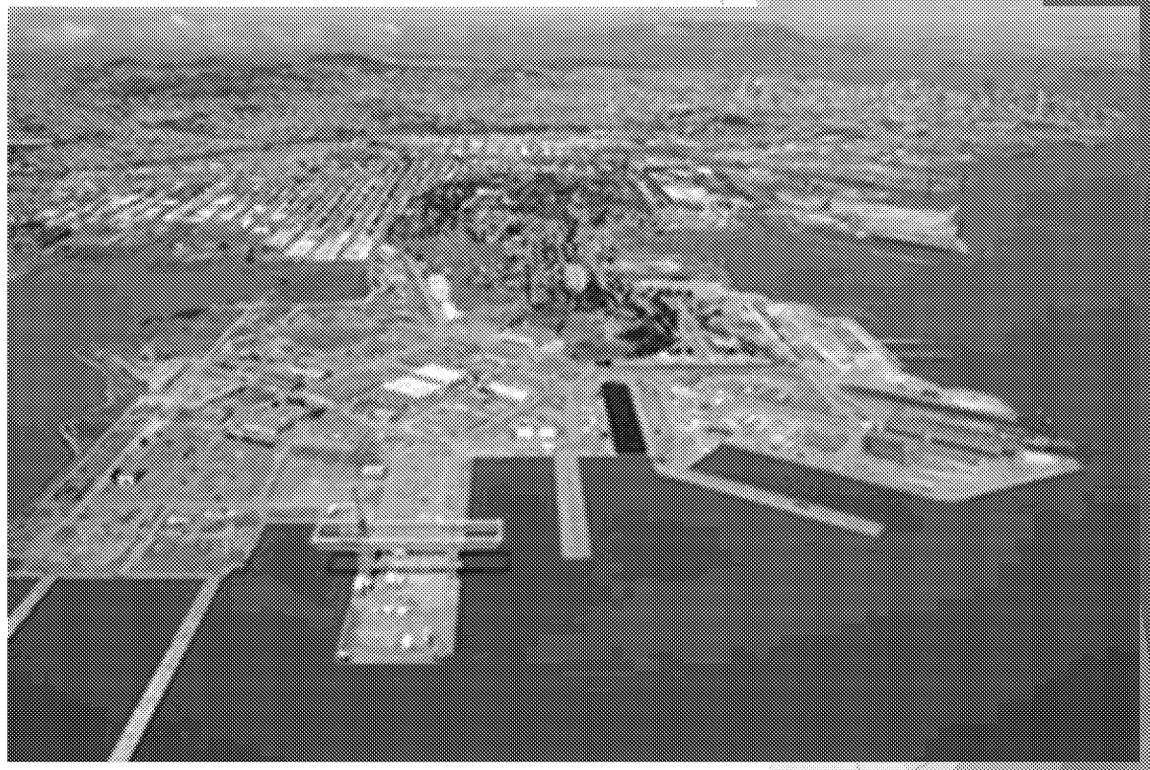
Hunters Point Naval Shipyard Radiological Data Evaluation



Lyndsey Nguyen & David Kappelman, ERT

April 5, 2018

City's and Developer's Plans

- Redevelopment Plans for over 10,000 homes, 10,000 jobs, R&D space, and parks.
- A third of homes will be below market rate.
- The Shipyard offers over 450 acres. Congress has been providing $80 million/year to speed Navy cleanup and transfer. Total planned cleanup > $1 billion, before addressing Tetra Tech EC Inc. falsification

Founded as a commercial dry dock

1869

1939

Purchased by US Navy

Navy Radiological Uses

1939 to 1974

1976

Leased to Triple A Machine Shop

Navy ends leasing

1986

1991

Placed on BRAC list

HPNS dry docks
1940

USS Iowa in dry dock at HPNS
1953

What were the Navy uses of radiation at HPNS?

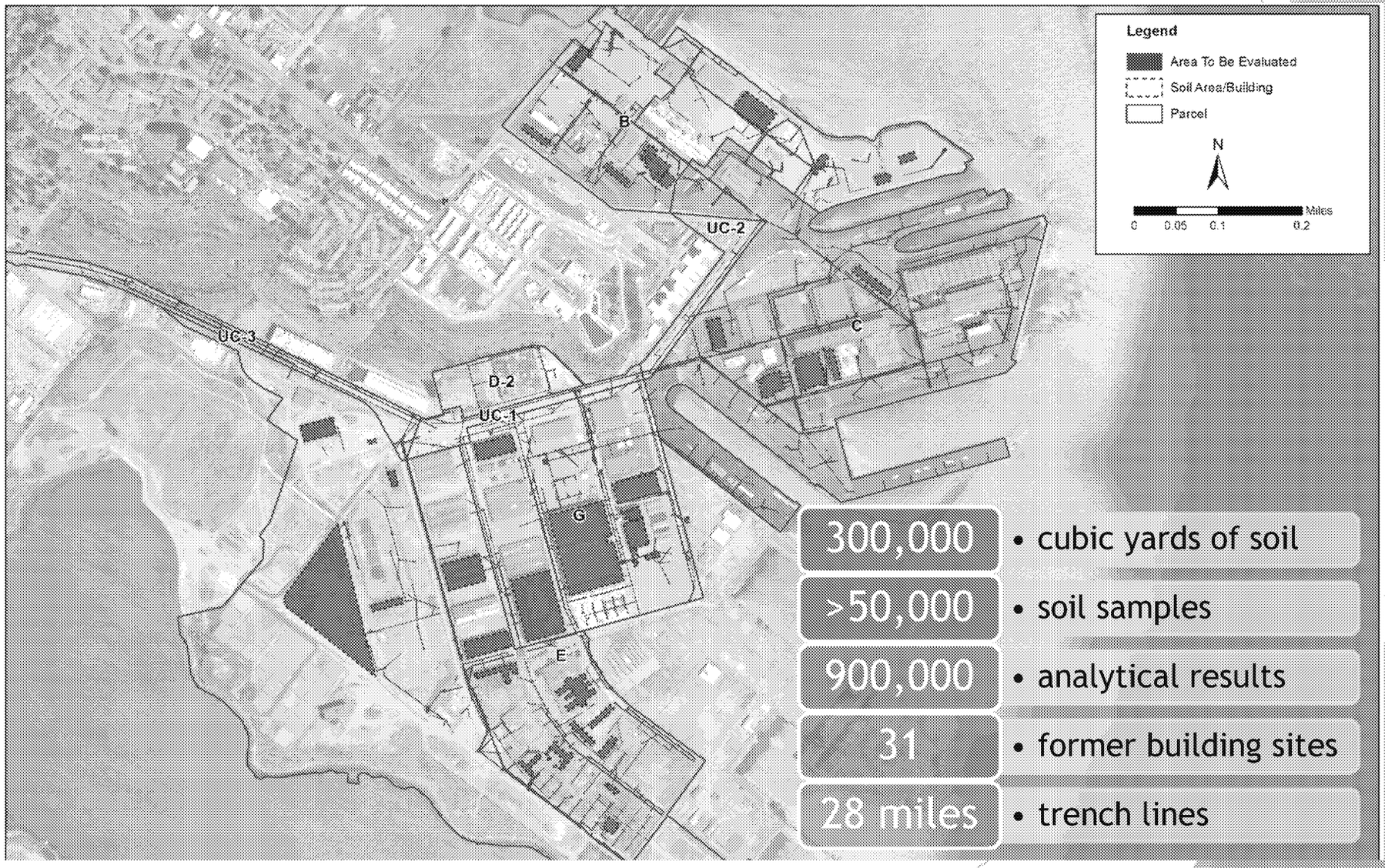
Historical activities at HPNS

- **Ship repair and maintenance**
- **Testing and decontaminating ships**
- **Navy Radiological Defense Laboratory (NRDL) testing**
- **Waste disposal practices**

Where are the potentially contaminated areas at HPNS?

- Buildings with historical radiological use
- Sanitary sewer and storm drain lines (removed)
- Former disposal/burial areas
- Piers and ship berths

Size and Scope of Tetra Tech EC Inc. Radiological work



- 300,000 • cubic yards of soil
- >50,000 • soil samples
- 900,000 • analytical results
- 31 • former building sites
- 28 miles • trench lines

Tetra Tech EC Inc. performed 12 years of radiological work costing $240 million

- Removed 28 miles of sewer/storm drain lines, during which supposedly 2% of piping required disposal as radioactive waste
- Removed more than 300,000 of soil in support of sanitary sewer and storm drain line removal; supposedly 5% of soil required disposal as radioactive waste

How does the Navy address radiological contamination at HPNS?

Soil Sampling

Building Scanning

Soil and Sewer Line Removal

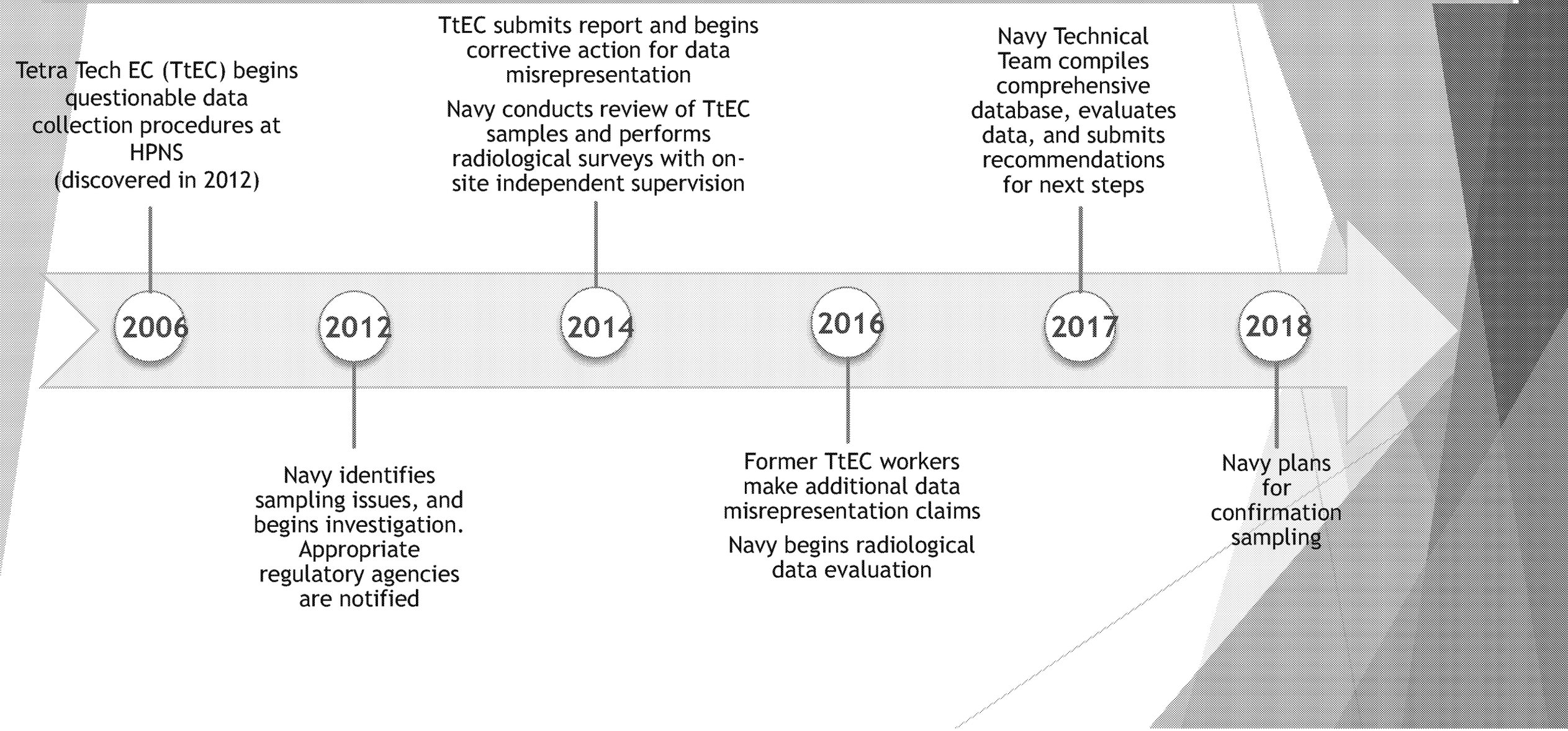
- Evaluate by sampling and scanning
- Monitor the environment
  - Air monitoring
  - Perimeter scanning
  - Equipment and personnel
- Remove sources or construct protective barriers
- Confirm the safety of response
- Report to agencies and the public

All responses are performed in coordination with and reported to agencies: EPA, DTSC, CDPH, SFDPH

Scanning excavated overburden

- After removal from storm drain/sewer line trenches, place on Radiation Screening Yards 6” depth. Gamma scan entire surface

HPNS Radiological Data Evaluation Timeline



Radiological Data Investigation (2012)

Why did the Navy start to question data?

- In 2012, Navy review of radiological sampling data found anomalous results that could not be explained
- The Navy discovered that one of its radiological remediation contractors (Tetra Tech EC), had misrepresented radiological data

What was done after discovery of the misrepresented data?

- Tetra Tech EC performed an internal investigation, and presented results to the Navy in "Anomalous Soil Sampling Report" based on K-40 anomalies (386 samples redone) and reported findings to regulators
- New remediation at 5 locations where they found and removed additional contamination

Feb 2016 NRC Notice of Apparent Violation

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC NEWS
Office of Public Affairs, Region I
King of Prussia, PA 19406-2713
www.nrc.gov ■ opa1.resource@nrc.gov

The violation involves the failure by Tetra Tech to make surveys that were reasonable to evaluate concentrations and potential radiological hazards of residual radioactivity. Specifically, a radiation control technician and a radiation task supervisor deliberately falsified soil sample records by taking soil samples from areas not designated as part of the target area and by completing forms with inaccurate information on a number of occasions in late 2011 through mid-2012. The falsified records that were the subject of NRC's investigation were identified by the Navy prior to any buildings or land being released. Tetra Tech took actions to correct the issue and prevent recurrence, including re-sampling of suspect areas.

In July, NRC issued a notice of violation and proposed a $7,000 civil penalty. In response, Tetra Tech informed the agency that they were interested in the use of the ADR session to resolve the matter. ADR is a process in which a neutral mediator with no decision-making authority assists the parties in reaching an agreement or resolving any differences regarding a dispute.

Current Radiological Data Re-Evaluation

Why are radiological sample results being questioned again?

- In 3/2016, a former Tetra Tech EC employee made new allegations of improper sampling and cleanup activities
- In 2017, six more former Tetra Tech EC employees made further allegations

The next month, NBC news reported . . .

https://w
area.com/i
ons/Former
Point-Worker
Supervisors-O
Him-to-Hide-
Radiation-
371723561.html

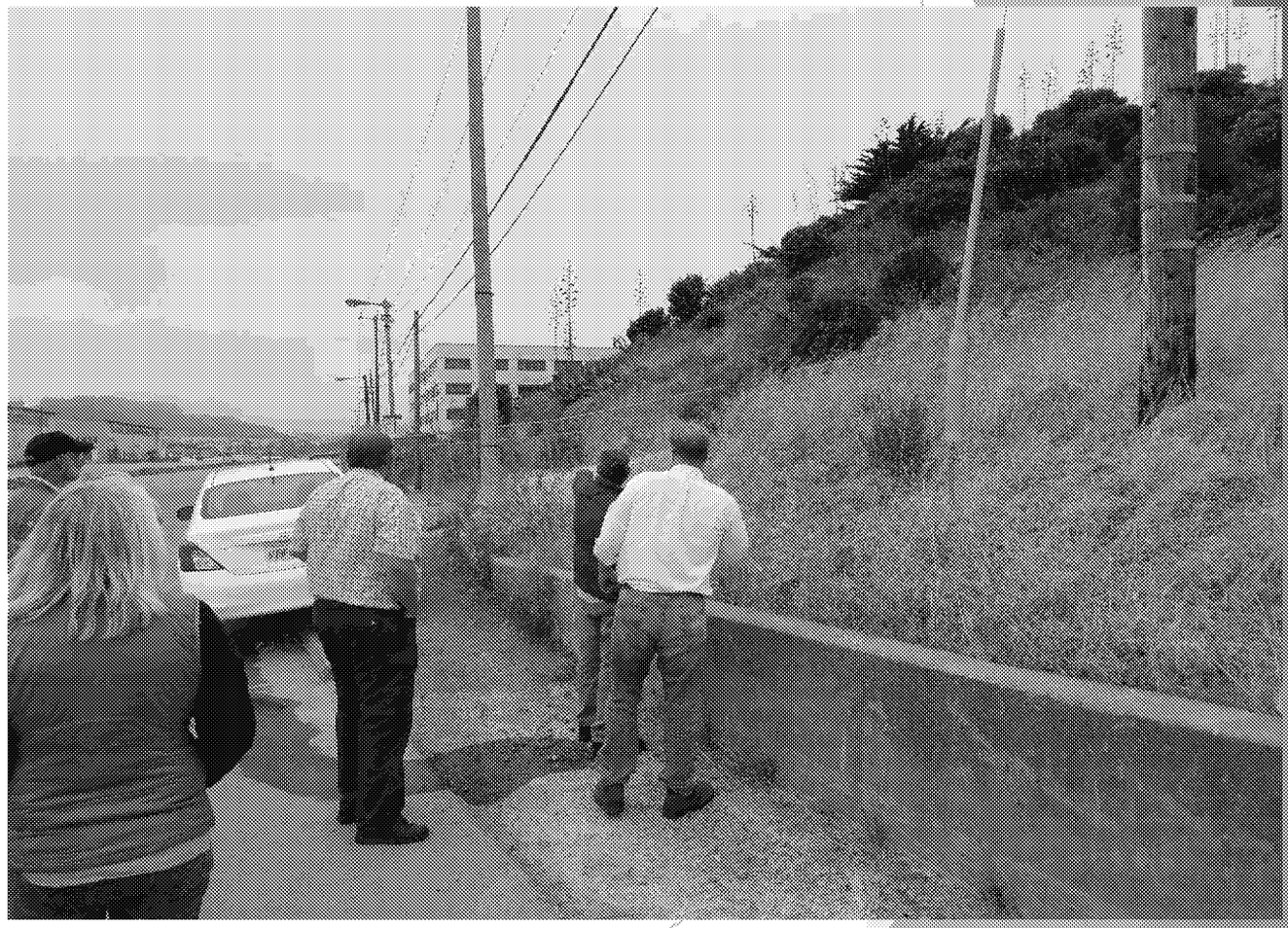
Examples of Allegations in soil

- Swapped samples from stockpile and dumped real samples in open trenches
- Disappeared a sample under Bldg 351A

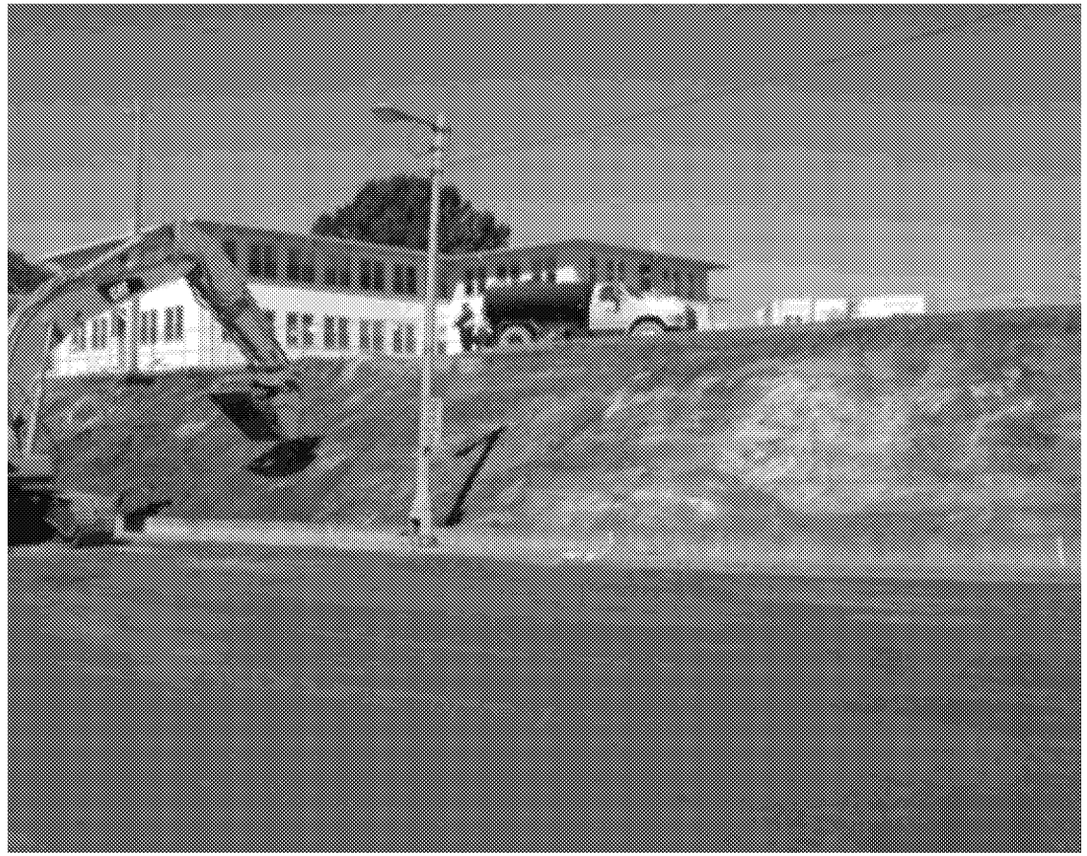
One example of numerous NBC TV News segments

Commercial Kitchen

Concern about a Cs-137 finding near new construction of a new commercial kitchen for local small businesses.



Already excavated to Bedrock afterwards



NRC Petition & press conference
7 former workers gave statements

- Moved gamma scanner faster than required and held too far away from soil
- Ignored frequent alarms from portal monitor for trucks departing the site and reduced sensitivity of alarms

Allegations in 21 Buildings

- Scan Speed
  - Detector scanning rate in Class 1 survey units was faster (up to 16 cm/s) than approved rate (1.37 cm/s)
- Detector Movement
  - Detector was not moved during some Class 2 and 3 scans
- Manipulation of Data
  - Collected data was substituted with false post-scan data
  - Collected data was manipulated e.g., highest and lowest data deleted

Current Radiological Data Re-Evaluation

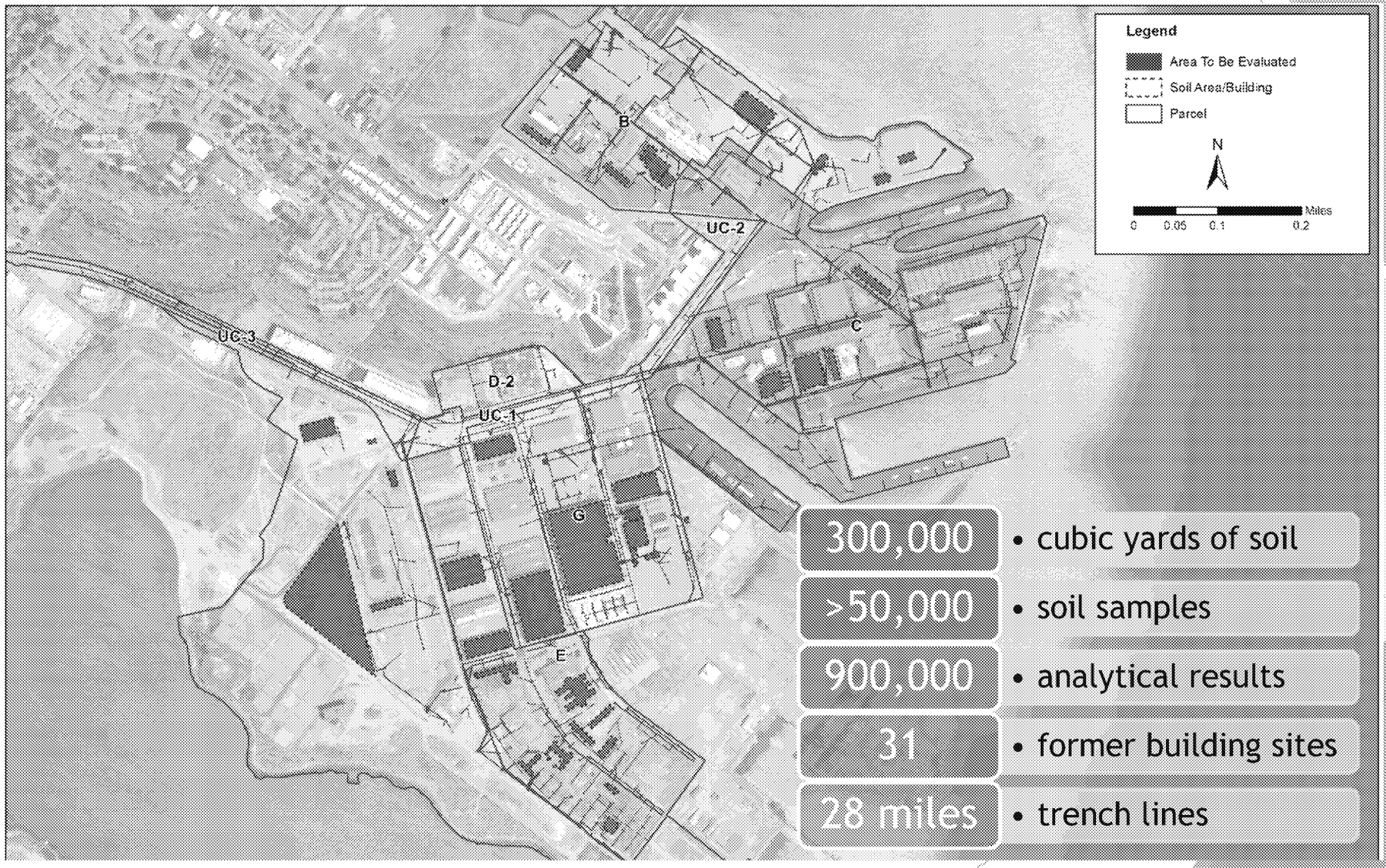
How is the Navy addressing new allegations?

- First priority was to evaluate the allegations and determine whether those who live and work on or near HPNS are being exposed to harmful radiation - That evaluation indicated it is safe to live and work here
- The Navy has assembled a team of technical experts to evaluate information and existing data

Navy consultant team

- CH2M and Jacobs
- Cabrera
- Batelle
- Perma Fix
- Community Technical Advisor: Oregon State University
- 3rd party reviewer: Oak Ridge Associated Universities
- And others

Size and Scope of Current Evaluation



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- >50,000 • soil samples
- 900,000 • analytical results
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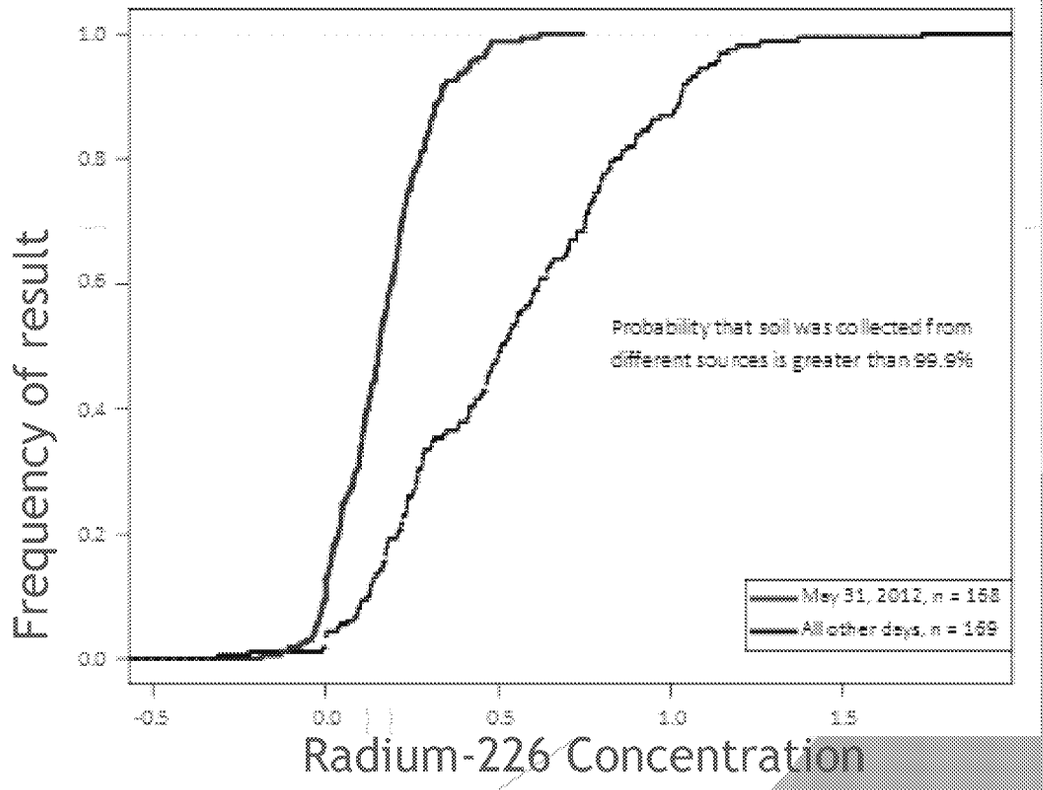
- 28 miles • trench lines

Data Evaluation Method - Statistics

- Statistical tests are very efficient and can look at a lot of data
- Statistical tests may give signs of whether the radiological data is genuine or falsified
- 5 types of statistical tests used for soil sampling and building scan data

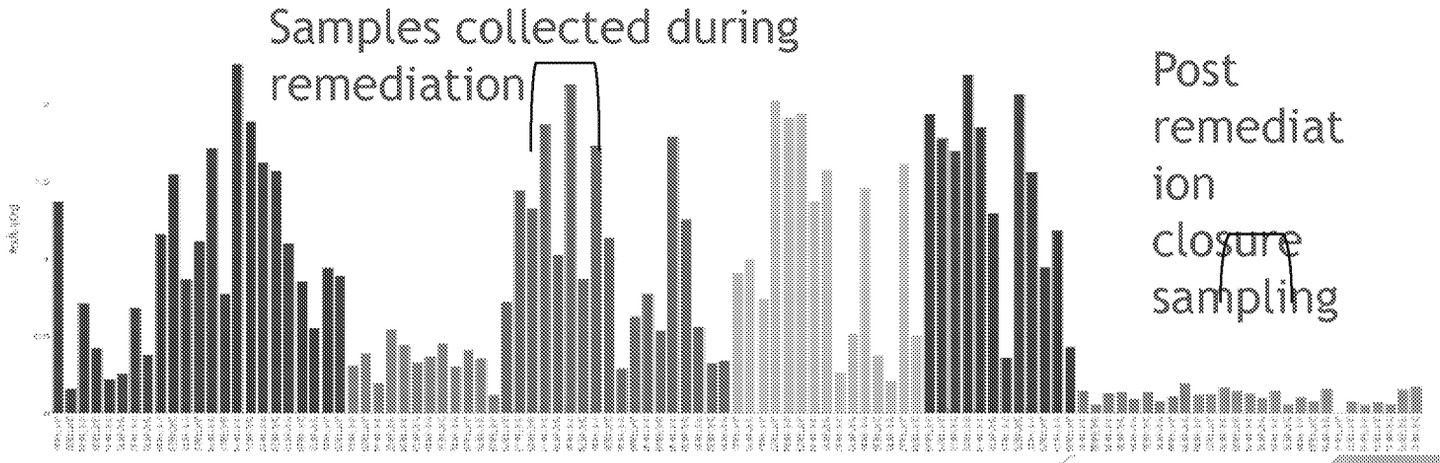
Example of statistical analysis: The graph shows how often a concentration of Radium 226 was detected in a survey unit. The red line shows the frequency of Radium - 226 concentrations for May 31, 2012, and the black line shows the pattern for all other days of sampling the survey unit. This shows that the data collected on May 31, 2012 are not from the same area as all the other samples from the survey unit, and are suspected to be fraudulent. This also shows that statistical methods work.



Data Evaluation Method – Logic Tests

- Inconsistencies in data and methods:
  - Samples collected on different day than rest of survey unit
  - Timing on sample collection
  - Samples analyzed before records say they were collected
- Unusual patterns in analytical and scan data

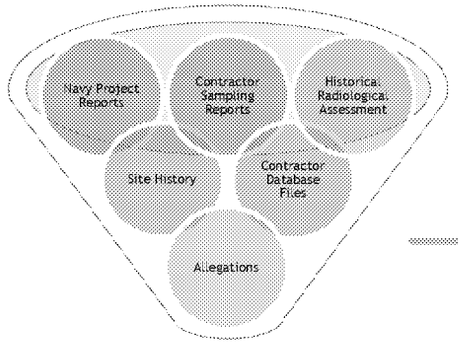
Example of unusual pattern: Ac-228 is a naturally occurring radionuclide, and should be detected within a consistent range within a survey unit. In evaluating data from soil sampling it was determined that Ac-228 concentrations decreased suddenly while sampling for closure of survey unit when compared to previously sampling in the same survey unit.



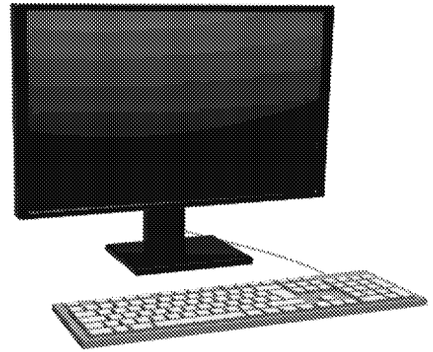
Example: Building 366, SU 2

CountOfString 9 BetaCPM1	String 10 BetaCPM	New_auto_id	BetaCPM	Bldg	SurveyUnit	DataType	ID	RdgNum
2	204154140122129144168170131	65712	204	366	2	ABSC	92048	70
2	15414012212914416817013112 6	65713	154	366	2	ABSC	92049	71
2	14012212914416817013112682	65714	140	366	2	ABSC	92050	72
2	12212914416817013112682106	65715	122	366	2	ABSC	92051	73
2	12914416817013112682106129	65716	129	366	2	ABSC	92052	74
2	14416817013112682106129169	65717	144	366	2	ABSC	92053	75
2	16817013112682106129169144	65718	168	366	2	ABSC	92054	76
2	17013112682106129169144139	65719	170	366	2	ABSC	92055	77
2	13112682106129169144139201	65720	131	366	2	ABSC	92056	78
2	12682106129169144139201171	65721	126	366	2	ABSC	92057	79
2	82106129169144139201171176	65722	82	366	2	ABSC	92058	80
2	106129169144139201171176180	65723	106	366	2	ABSC	92059	81
2	12916914413920117117618012 3	65724	129	366	2	ABSC	92060	82
2	16914413920117117618012319 3	65725	169	366	2	ABSC	92061	83
2	14413920117117618012319313 5	65726	144	366	2	ABSC	92062	84
2	13920117117618012319313512 0	65727	139	366	2	ABSC	92063	85
2	20117117618012319313512012 5	65728	201	366	2	ABSC	92064	[illegible]
2	27016913095105103102130109	65737	270	366	2	ABSC	92073	[illegible]
2	16913095105103102130109101	65738	169	366	2	ABSC	92074	96
2	13095105103102130109101104	65739	130	366	2	ABSC	92075	97

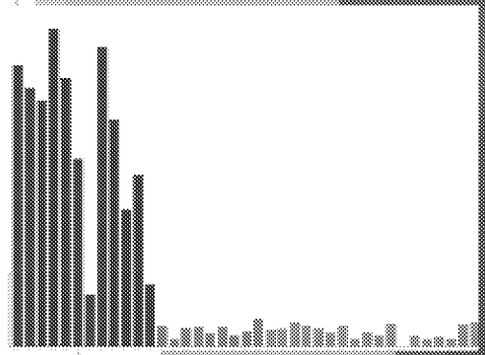
Process



Gather Data

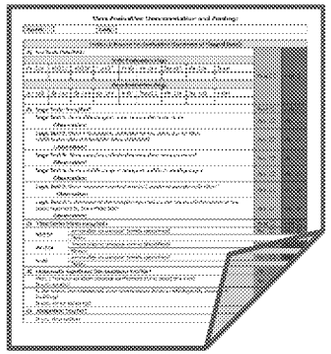


Compile Database



Analyze Data

In progress



Evaluate Findings

Develop Sampling Plan

Collect New Data

Determine Next Steps

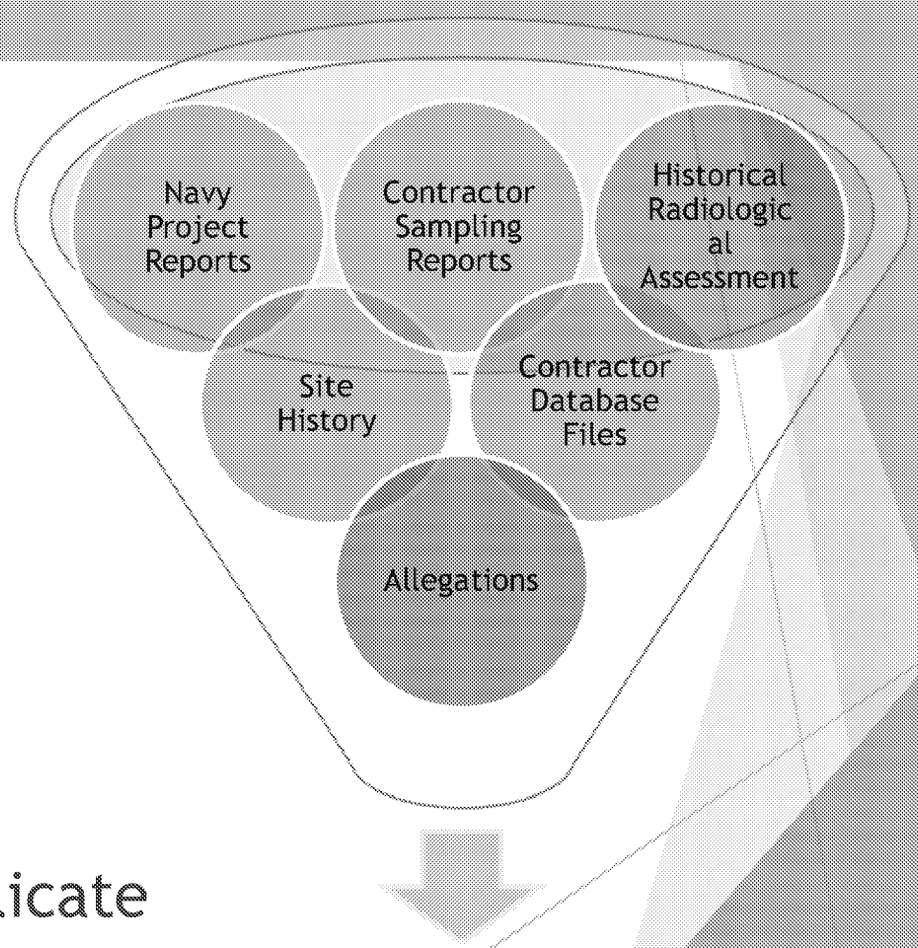
Gather Data

Purpose: To collect all relevant information

Status: *COMPLETE*

Activities

- ✓ Collected all background and TtEC radiological sample data
  - ❖ Navy project reports
  - ❖ Sampling results
  - ❖ Reference data
  - ❖ Database files
- ✓ Cross-referenced data to remove duplicate information
- ✓ Categorized data for future analysis



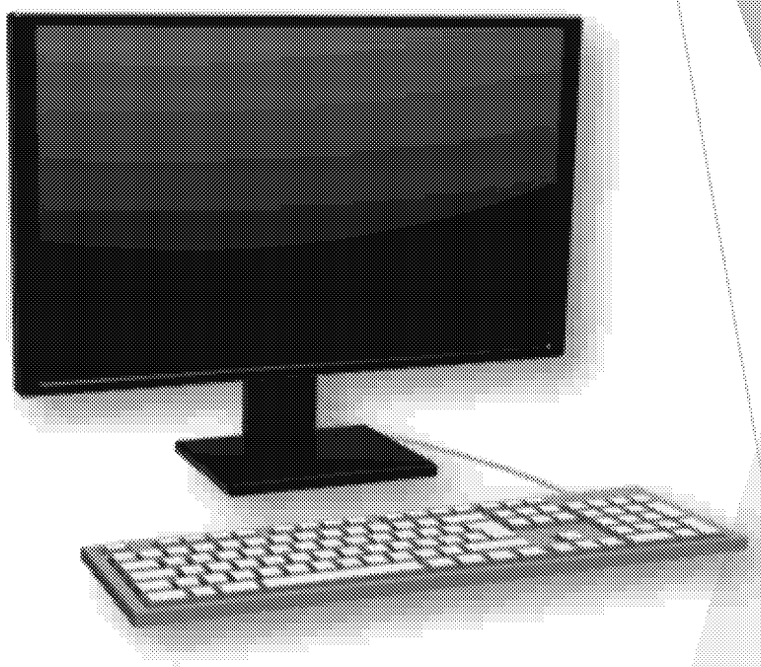
Compile Database

Purpose: To establish an accurate database

Status: *COMPLETE*

Activities

- ✓ Compiled electronic database
  - ❖ Radiological soil samples
  - ❖ Radiological scans
- ✓ Conducted quality control review



Analyze Data

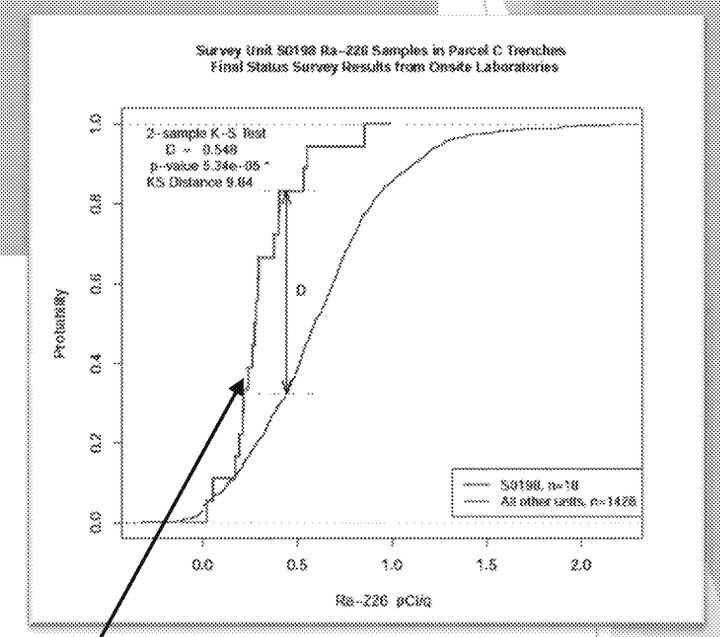
Purpose: To identify inconsistencies in data

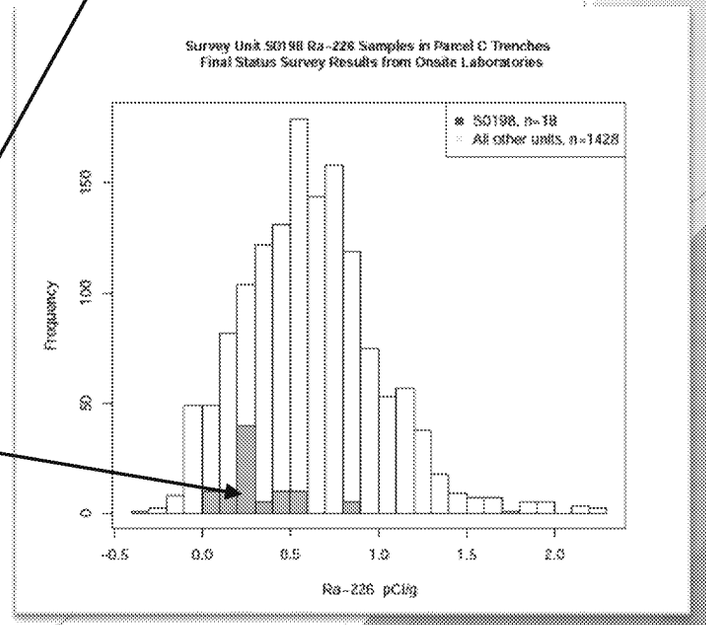
Status: *COMPLETE*

Activities

- ✓ Conducted standardized analysis on all sample results
  - ❖ Performed **statistical tests** to identify data inconsistencies
  - ❖ Performed **logic tests** to confirm if results "make sense"

Differences in data show that samples are not from the same sample collection location.



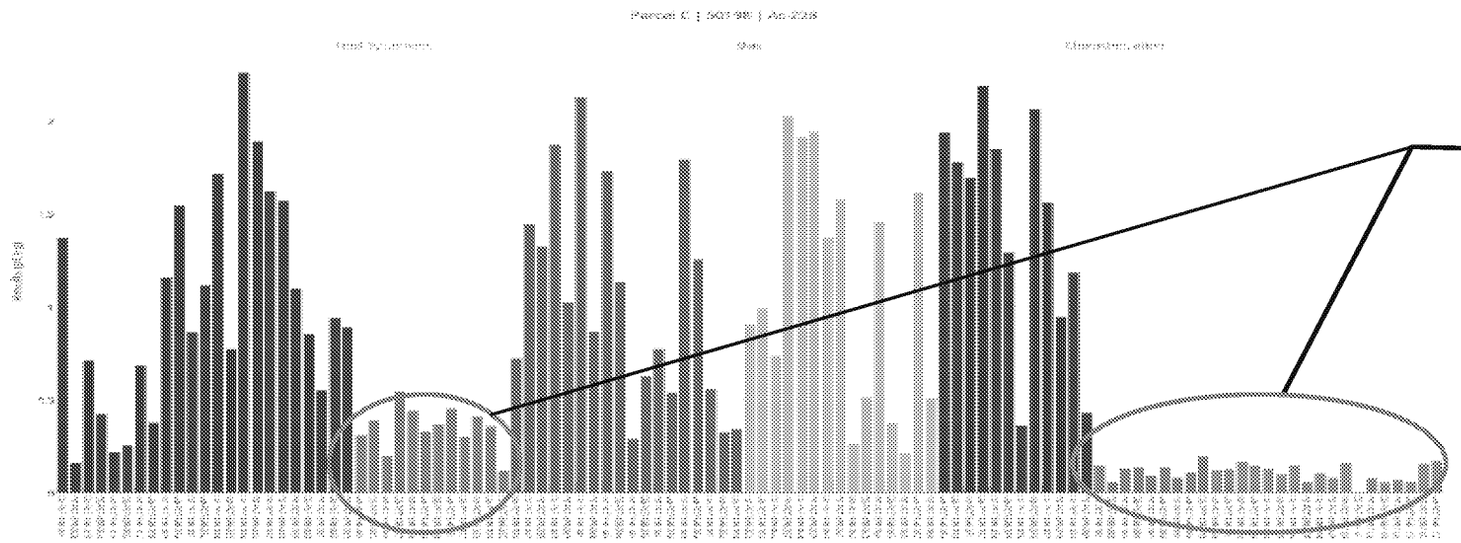


Analyze Data (continued)

Purpose: To identify inconsistencies in data

Status: *COMPLETE*

Example of Analysis Method - *Graphical Analysis*



These sample results should be of similar range and variability as other sample results.

Graphical representation of multiple samples collected on different days.

- Vertical bars represent sample concentrations.

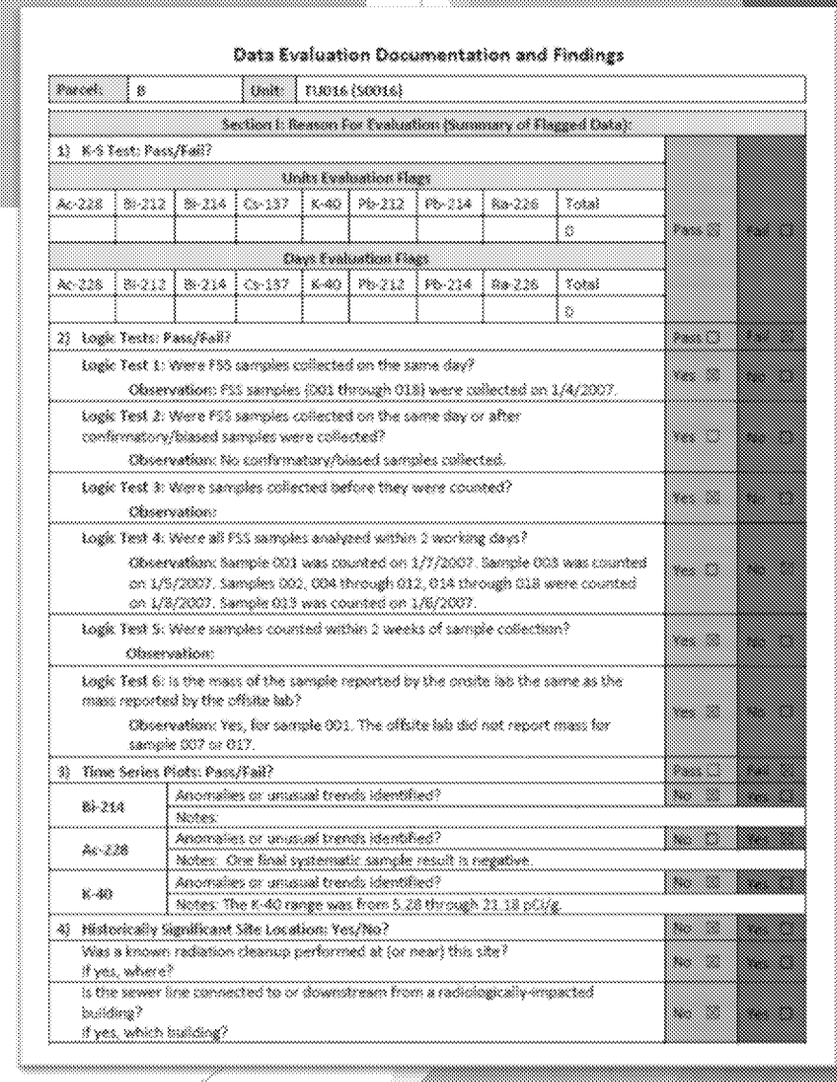
Evaluate Findings

Purpose: To determine accuracy of data

Status: *Regulatory agencies are reviewing*

Activities

- ✓ Flagged unusual or suspect data
  - Statistical inconsistencies
  - Logic test inconsistencies
- ✓ Cross-referenced additional data
  - Sites with possible history of radiological contamination
  - Sites referenced in allegations



Data Evaluation Documentation and Findings

Parcel:	B			Unit:	FUSD16 (SD016)						
Section I: Reason For Evaluation (Summary of Flagged Data):											
1) K-S Test: Pass/Fail?											
Units Evaluation Flags											
Ac-228	Bi-212	Bi-214	Cs-137	K-40	Pb-212	Pb-214	Ra-226	Total			
								0	Pass ☑	Fail ☐	
Days Evaluation Flags											
Ac-228	Bi-212	Bi-214	Cs-137	K-40	Pb-212	Pb-214	Ra-226	Total			
								0			
2) Logic Tests: Pass/Fail?									Pass ☐	Fail ☐	
Logic Test 1: Were FSS samples collected on the same day? Observation: FSS samples (001 through 018) were collected on 1/4/2007.									Yes ☑	No ☐	
Logic Test 2: Were FSS samples collected on the same day or after confirmatory/biased samples were collected? Observation: No confirmatory/biased samples collected.									Yes ☐	No ☐	
Logic Test 3: Were samples collected before they were counted? Observation:									Yes ☑	No ☐	
Logic Test 4: Were all FSS samples analyzed within 2 working days? Observation: Sample 001 was counted on 1/7/2007. Sample 003 was counted on 1/9/2007. Samples 002, 004 through 012, 014 through 018 were counted on 1/8/2007. Sample 013 was counted on 1/8/2007.									Yes ☐	No ☑	
Logic Test 5: Were samples counted within 2 weeks of sample collection? Observation:									Yes ☑	No ☐	
Logic Test 6: Is the mass of the sample reported by the onsite lab the same as the mass reported by the offsite lab? Observation: Yes, for sample 001. The offsite lab did not report mass for sample 007 or 017.									Yes ☑	No ☐	
3) Time Series Plots: Pass/Fail?									Pass ☐	Fail ☐	
Bi-214	Anomalies or unusual trends identified?								No ☐	Yes ☐	
	Notes:										
Ac-228	Anomalies or unusual trends identified?								No ☐	Yes ☐	
	Notes: One final systematic sample result is negative.										
K-40	Anomalies or unusual trends identified?								No ☐	Yes ☐	
	Notes: The K-40 range was from 5.28 through 21.18 pCi/g.										
4) Historically Significant Site Location: Yes/No?									No ☐	Yes ☐	
Was a known radiation cleanup performed at (or near) this site? If yes, where?									No ☐	Yes ☐	
Is the sewer line connected to or downstream from a radiologically-impacted building? If yes, which building?									No ☐	Yes ☐	

Evaluate Findings

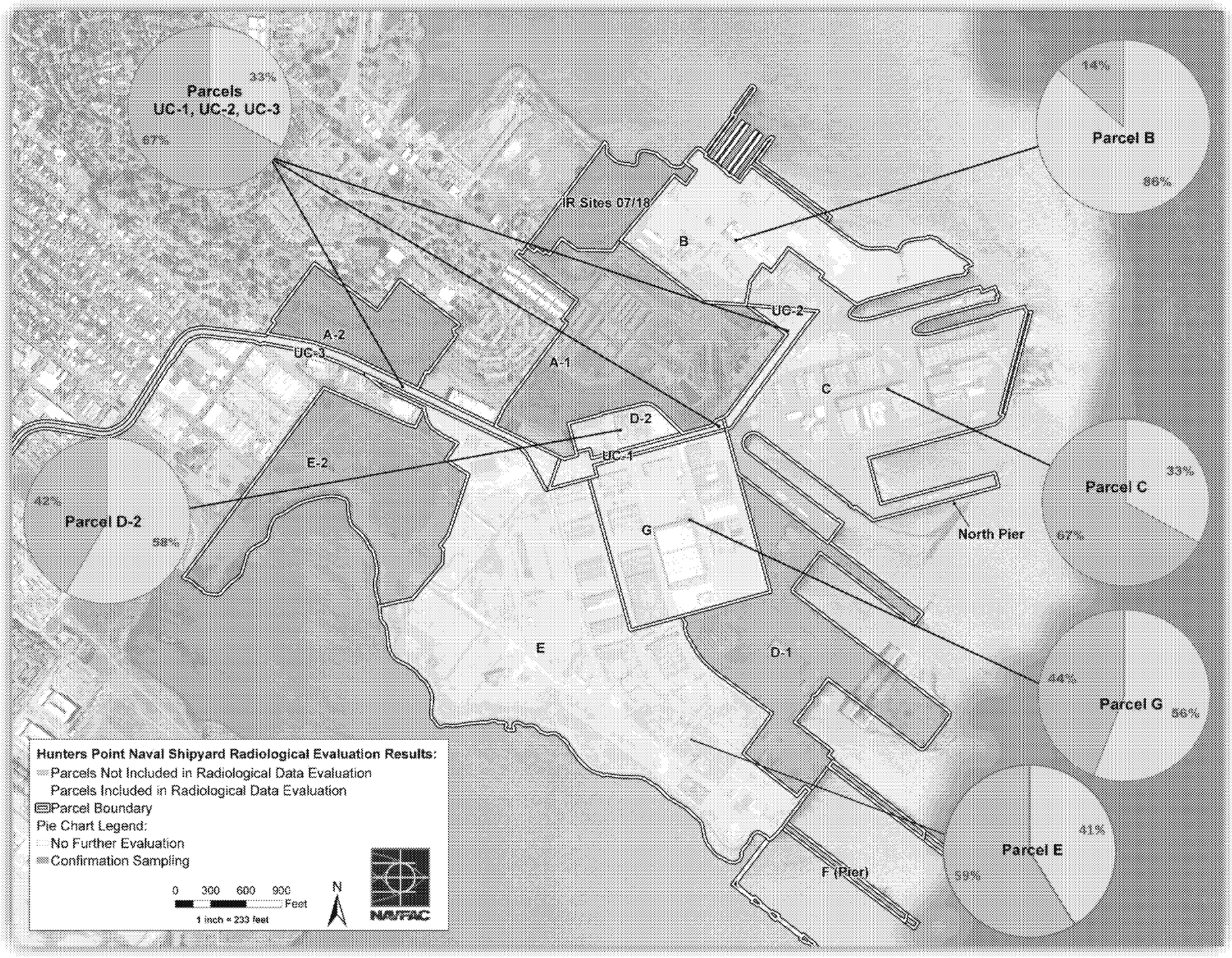
Purpose: To determine accuracy of data

Status: *COMPLETE*

Navy Findings

- ✓ Evidence of data falsification was found in multiple locations/areas
- ✓ Poor laboratory data quality and sample procedures complicate information already in question
- ✓ The Navy plans to collect new, independent data to validate the safety of the site for future use

Navy's Draft Results

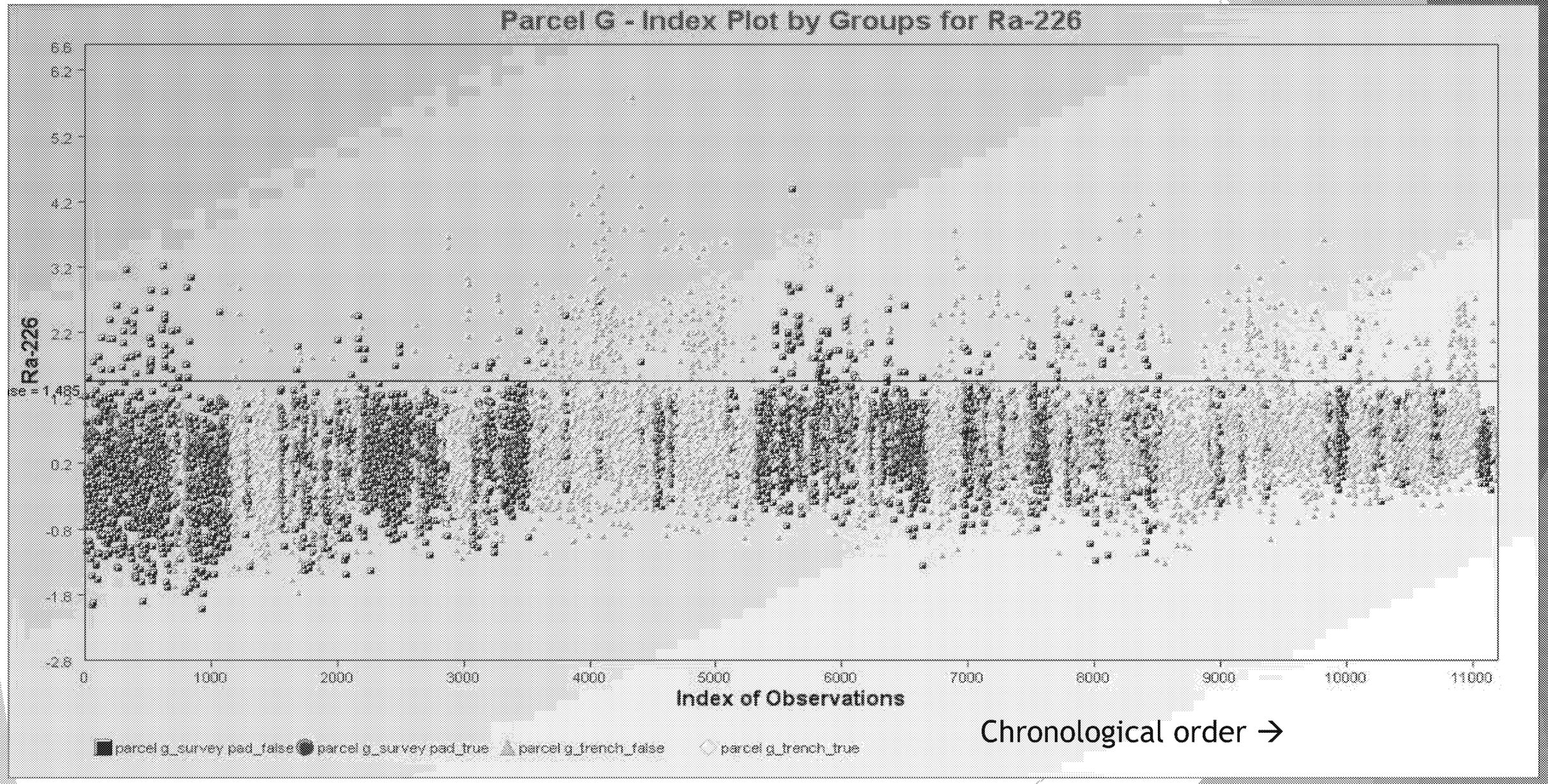


Navy & Regulators' findings of concerns

Location	Navy	EPA, DTSC, CDPH
Parcel B	14%	90%
Parcel G	44%	97%
Parcels D-2, UC-1, UC-2, UC-3	61%	93%

Signs of falsification found in data review

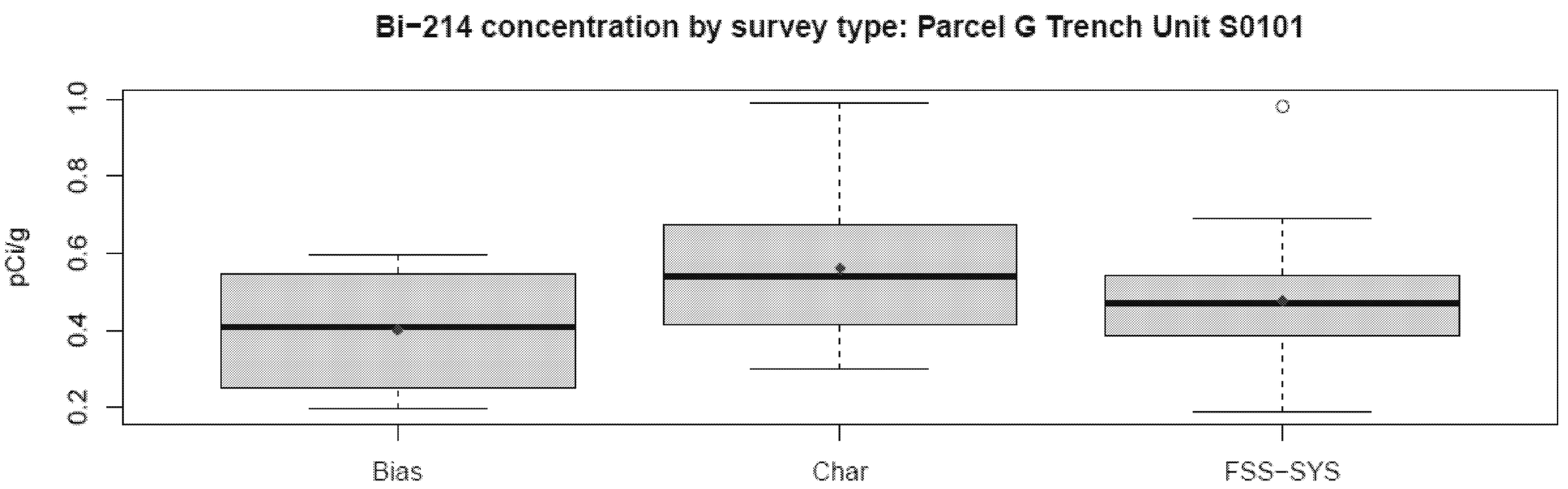
- Duplication of data
- Failure to collect biased samples even though gamma scan results exceeded investigation levels
- Different populations appeared to be present
- Differences between mass of samples sent to onsite vs. offsite laboratory

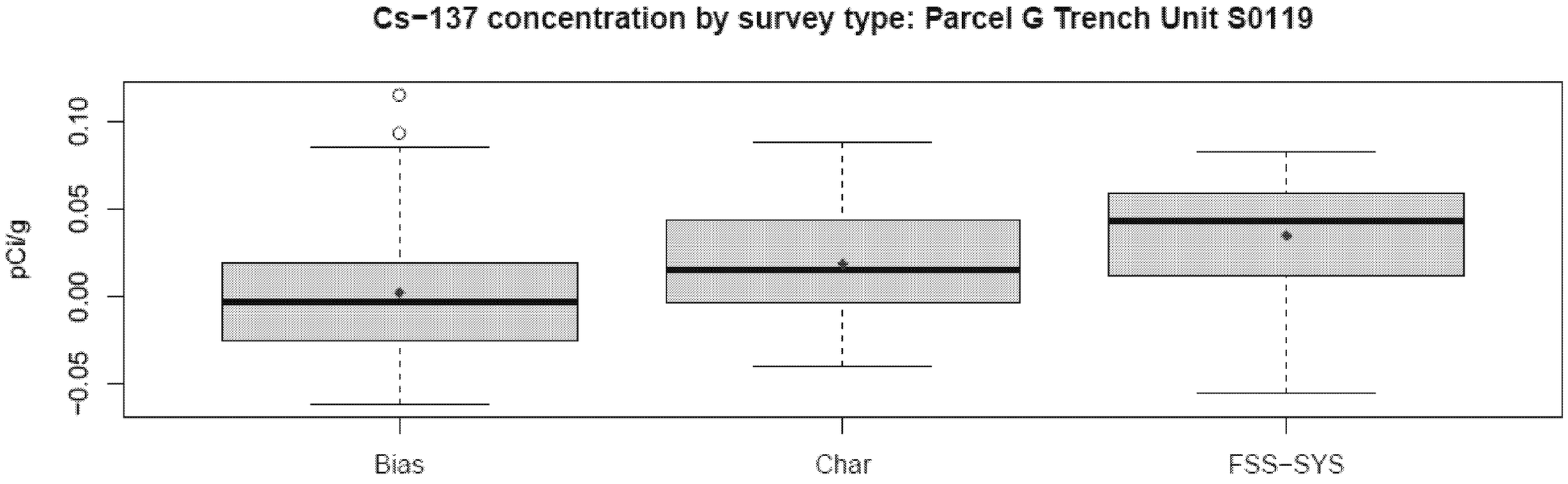

Parcel G - Index Plot by Groups for Ra-226
6.8
6.2
5.2
4.2
3.2
2.2
1.2
0.2
-0.8
-1.8
-2.8
Ra-226
se = 1.485
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
Index of Observations
parcel g_survey pad_false
parcel g_survey pad_true
parcel g_trench_false
parcel g_trench_true
Chronological order →

In Parcel G, out of the 43 trench units that the Navy had not already recommended resampling:

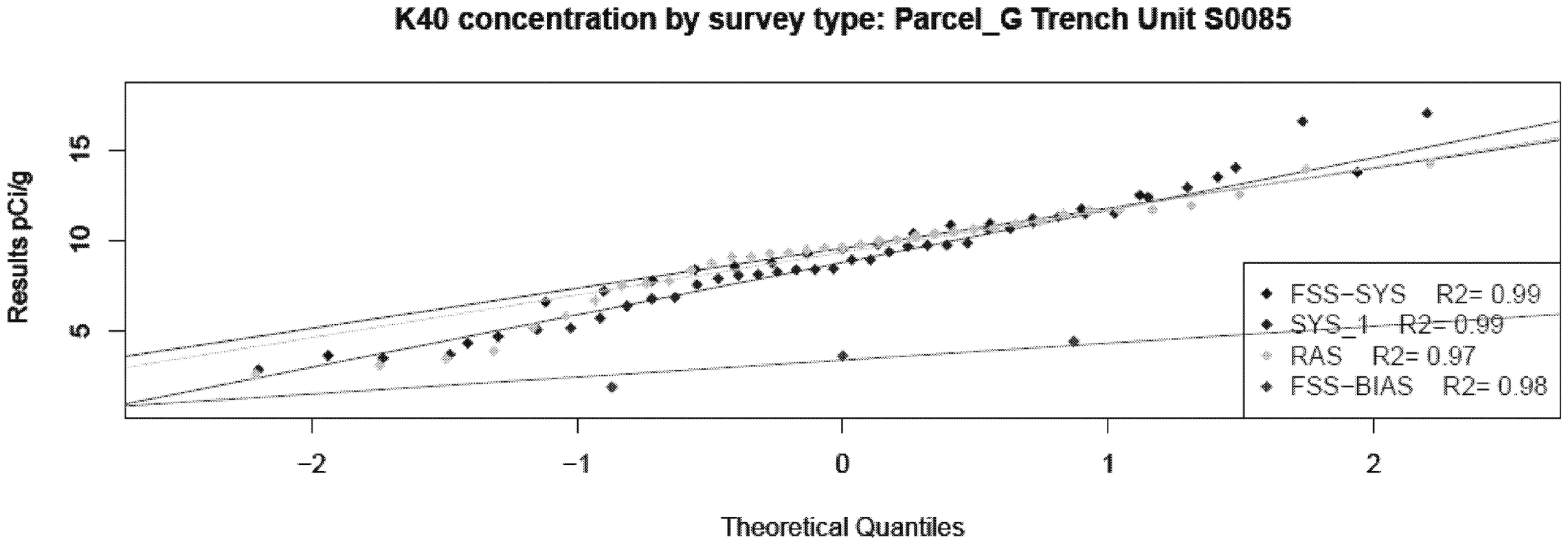
- Over half had inconsistencies between gamma scan and static data
- Over one-third had other types of inconsistencies (e.g. on-site and off-site lab results differ by more than 10 times, etc.)
- In a third, the narrow range of gamma static data indicates measurements were not collected from different locations, as required.
- Other concerns were found through data evaluation, and most trench units showed red flags of multiple types.

Biased sample results appeared lower than other data sets

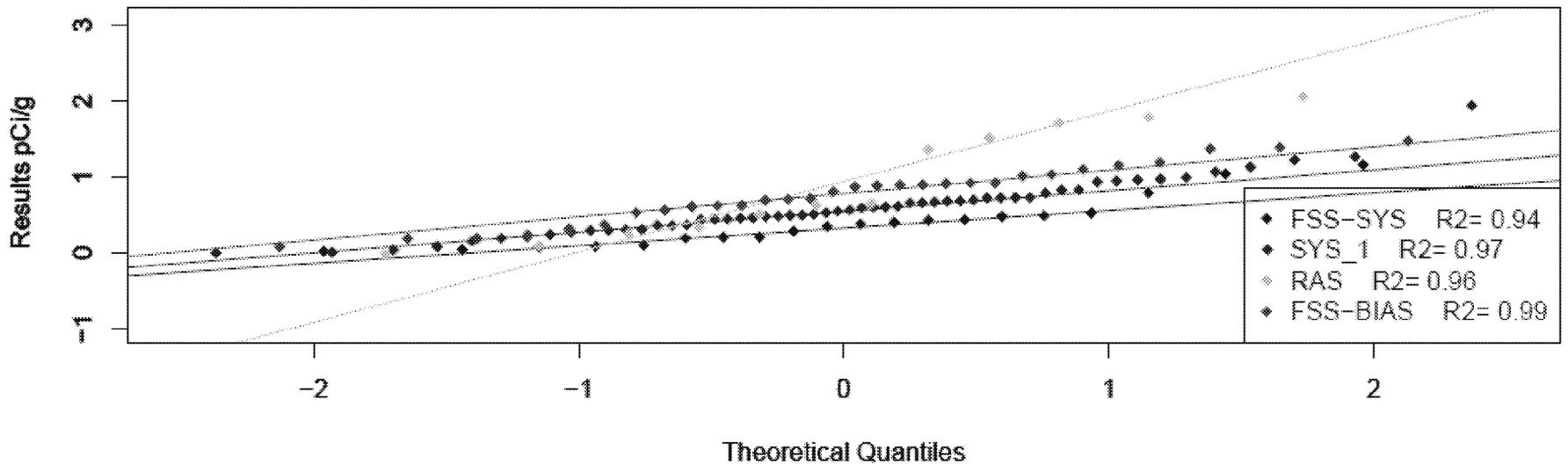



Cs−137 concentration by survey type: Parcel G Trench Unit S0119
pCi/g
−0.05
0.00
0.05
0.10
Bias
Char
FSS−SYS

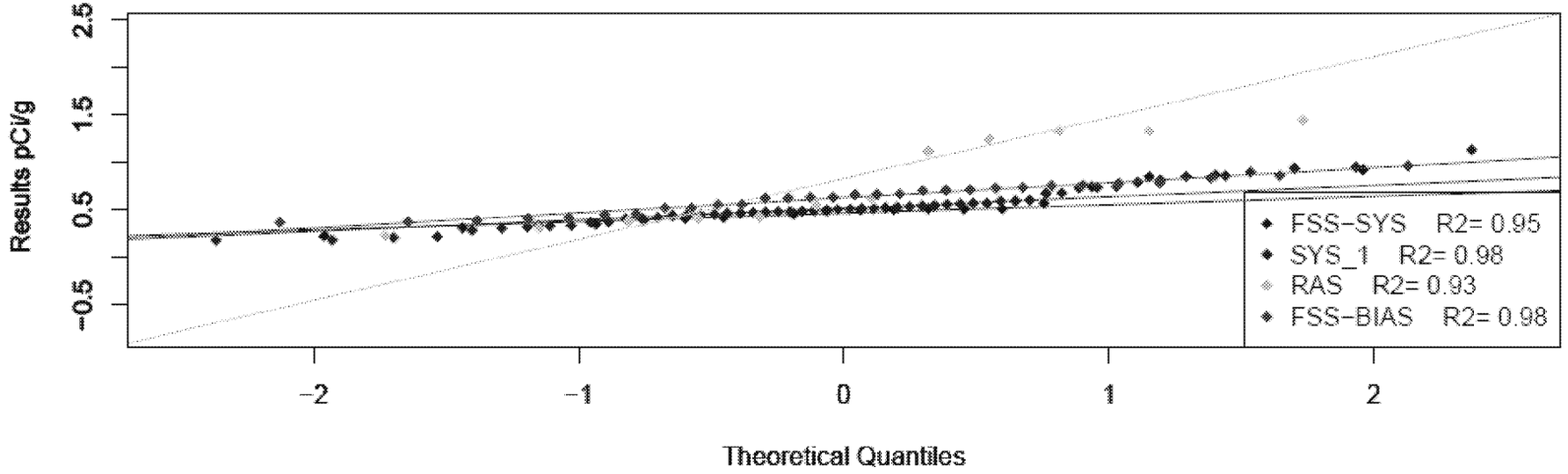
Plots showed signs that multiple sources of soil were likely in the data set

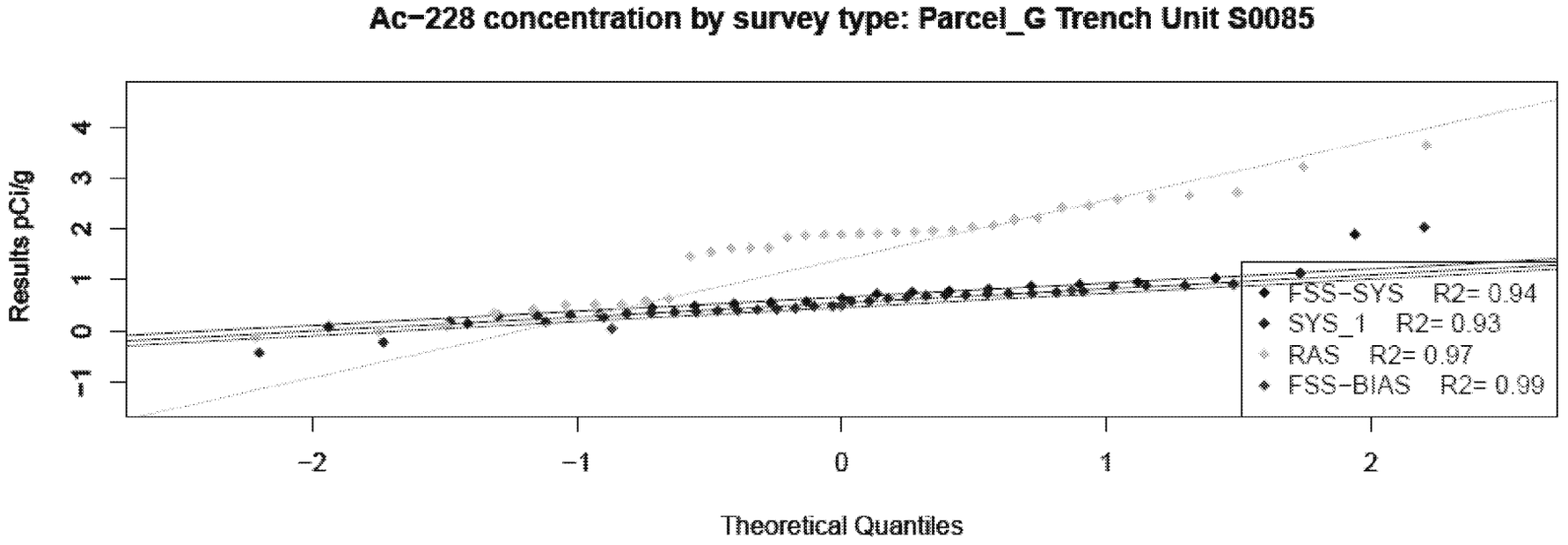


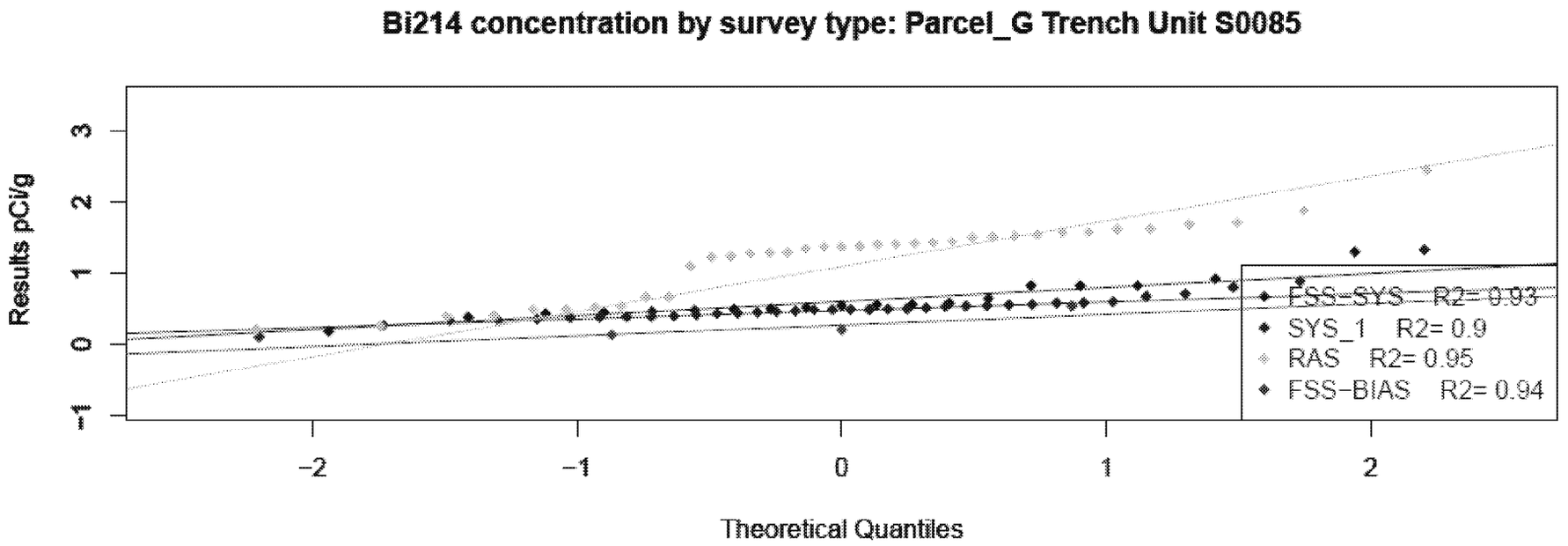
Ac-228 concentration by survey type: Parcel_G Trench Unit S0076

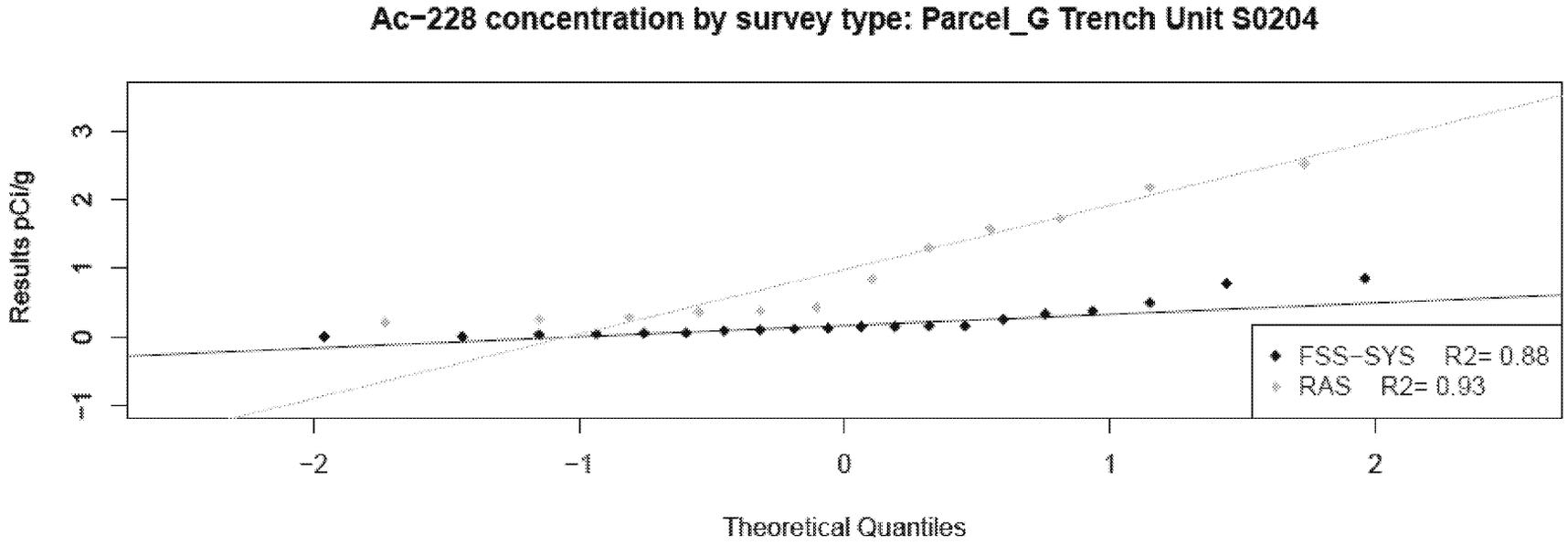


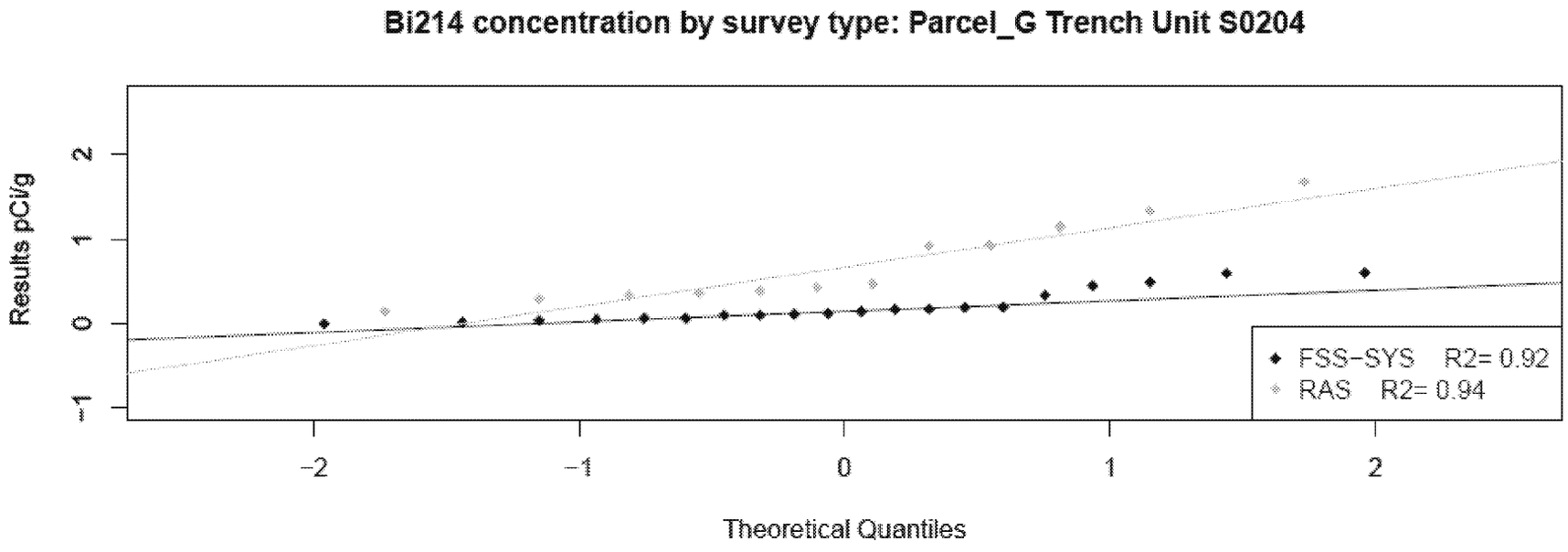
Bi214 concentration by survey type: Parcel_G Trench Unit S0076



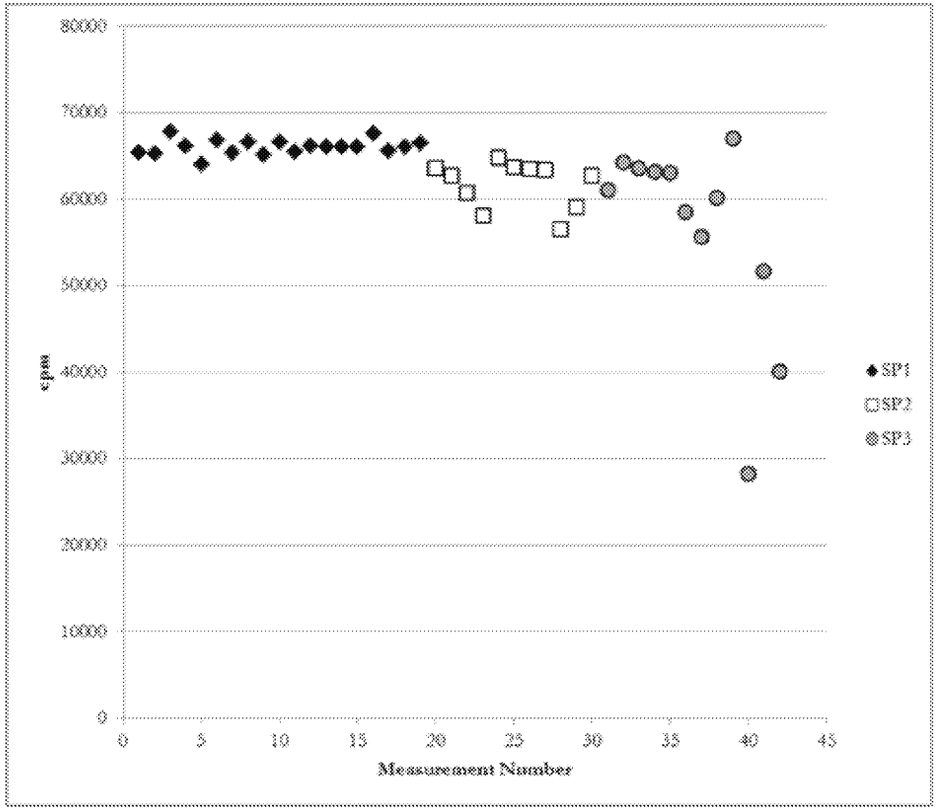

Ac−228 concentration by survey type: Parcel_G Trench Unit S0085
Results pCi/g
−1
0
1
2
3
4
−2
−1
0
1
2
Theoretical Quantiles
FSS−SYS R2= 0.94
SYS_1 R2= 0.93
RAS R2= 0.97
FSS−BIAS R2= 0.99


Bi214 concentration by survey type: Parcel_G Trench Unit S0085
Results pCi/g
−1
0
1
2
3
−2
−1
0
1
2
Theoretical Quantiles
FSS−SYS R2= 0.93
SYS_1 R2= 0.9
RAS R2= 0.95
FSS−BIAS R2= 0.94

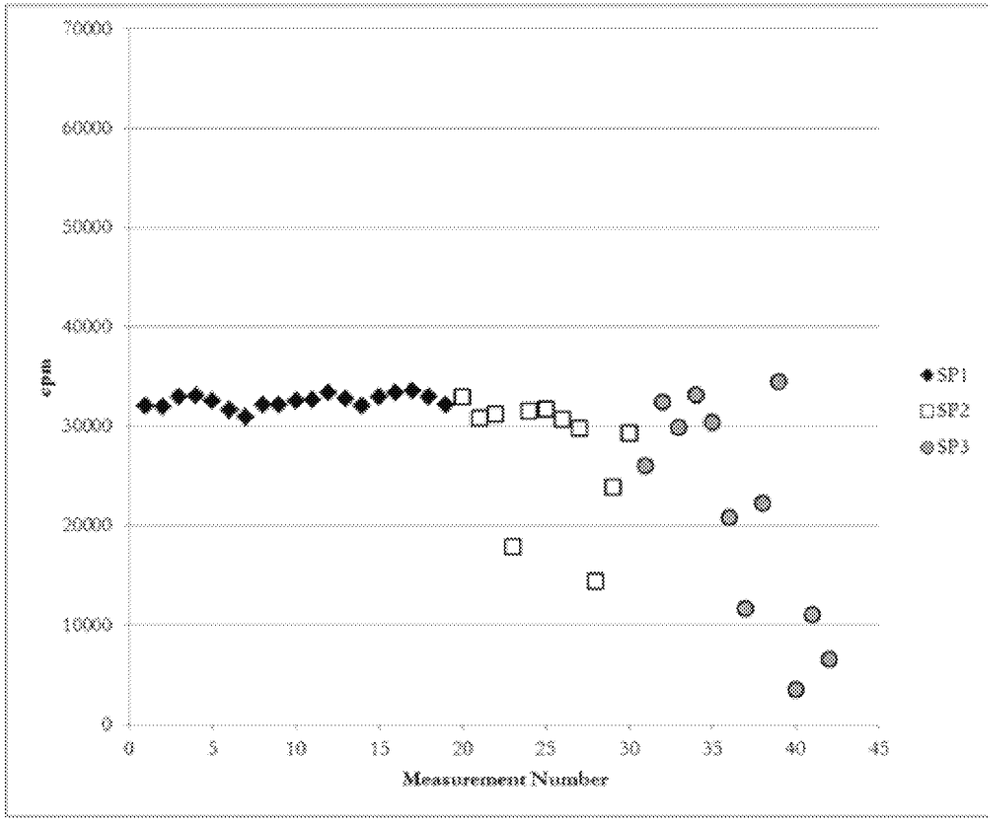

Ac−228 concentration by survey type: Parcel_G Trench Unit S0204
Results pCi/g
−1
0
1
2
3
−2
−1
0
1
2
Theoretical Quantiles
FSS−SYS R2= 0.88
RAS R2= 0.93


Bi214 concentration by survey type: Parcel_G Trench Unit S0204
Results pCi/g
−1
0
1
2
−2
−1
0
1
2
Theoretical Quantiles
FSS−SYS R2= 0.92
RAS R2= 0.94

Oak Ridge Associated Universities (ORAU)



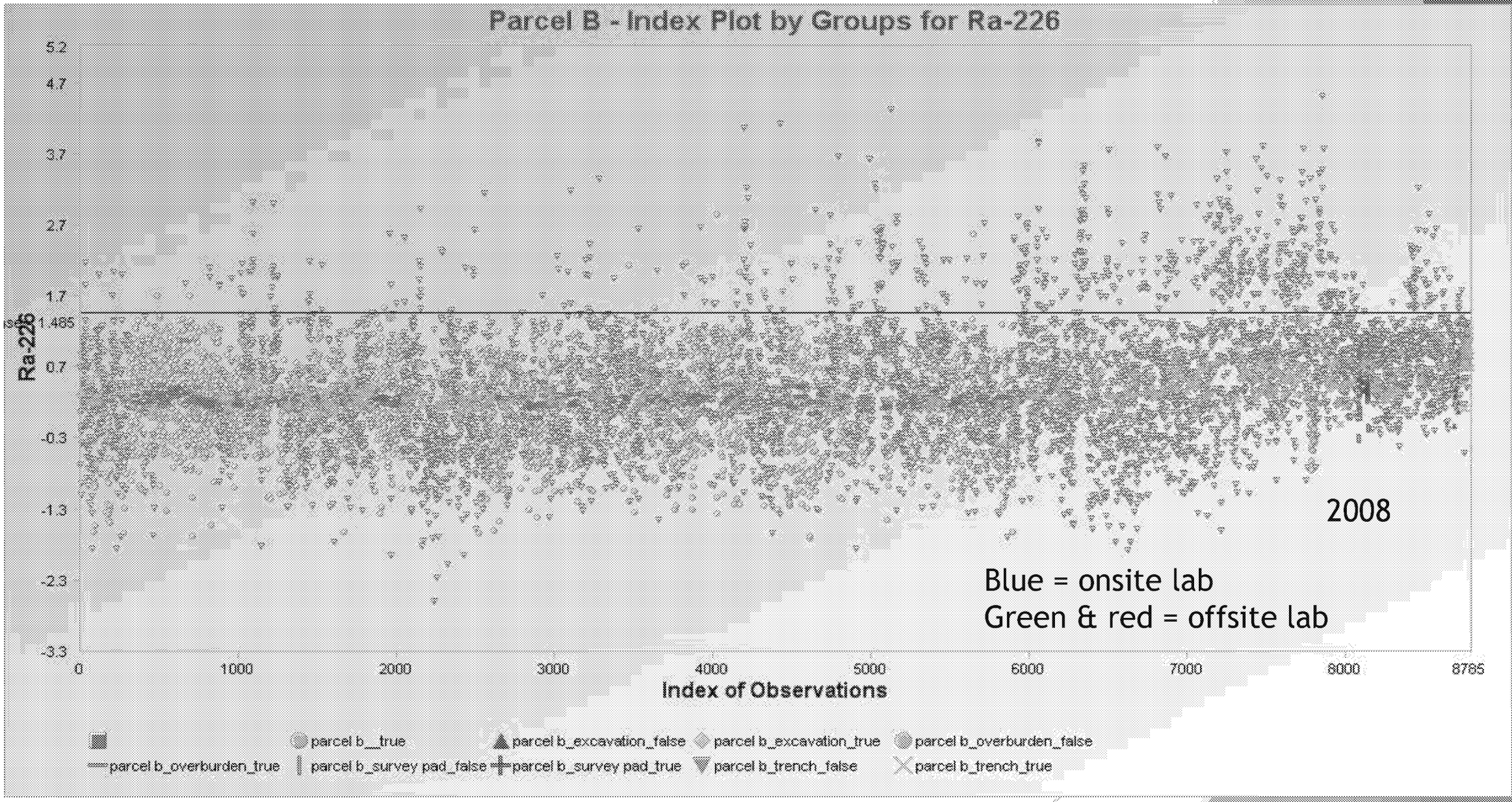
cpm for Cs-137 by Subpopulation at 900 Volts



cpm for Am-241 by Subpopulation at 900 Volts

Data quality problems found

- Missing scan data in 1/3 of Parcel B reports
- Many zero and negative results


Parcel B - Index Plot by Groups for Ra-226
5.2
4.7
3.7
2.7
1.7
1.485
0.7
-0.3
-1.3
-2.3
-3.3
Ra-226
0
1000
2000
3000
4000
5000
6000
7000
8000
8785
Index of Observations
2008
Blue = onsite lab
Green & red = offsite lab
parcel b__true
parcel b_excavation_false
parcel b_excavation_true
parcel b_overburden_false
parcel b_overburden_true
parcel b_survey pad_false
parcel b_survey pad_true
parcel b_trench_false
parcel b_trench_true

Determine Next Steps

Purpose: To develop plans for path forward

Status: *IN PROCESS*

Activities

- ✓ Document data evaluation results
- ✓ Develop an approach for collecting new data to confirm site safety
- ✓ Agree to a sampling/excavation approach with Regulatory Agencies

Confirmation Sampling Recommended!

Collection of additional data (surveys, scans, or soil samples) is recommended due to evidence of potential data manipulation and/or falsification

Determine Next Steps (continued)

Purpose: To develop plans for path forward

Status: *IN PROCESS*

Activities

- ✓ Prepare work plan for fieldwork
- ✓ Conduct fieldwork
- ✓ Continue to communicate progress to Regulatory Agencies and the community
- ✓ Continue to offer community resources

Questions?

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702-784-8018

David Kappelman (ERT)
859-594-6540

Lily Lee (Region 9)
415-947-4187

Extra photos if you want them: